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10/708,009	02/02/2004	Robert A. Calderoni	BUR920030153US1	2008

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EXAMINER

GEORGE, PATRICIA ANN

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 10/26/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/708,009

Applicant(s)

CALDERONI ET AL.

Examiner

Patricia A. George

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 24 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 18-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 2/2/04.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Election/Restrictions***

Claims 18-20 withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected group, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on August 30, 2005.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 7 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The percentage defined in claim 7 is unclear because the units of the percentage are not defined.

Claim 17 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The step of correlating in claim 17 is indefinite because the physical process step is not defined.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 4-6, 8, 12, and 14 are rejected under 35 U.S.C. 102(e) as being anticipated by Chen et al. of US 2004/0116080.

Chen et al. teaches all the limitations of claim 1. Chen et al. disclosed a method for real time monitoring of plasma, with physical vapor deposition, plasma-aided chemical vapor deposition, plasma etching technology, etc. (p.0002), through use of an impedance detector (p.0022), which is written on detecting, and can be applied in monitoring for agitation frequency of the instability of the RF plasma, mainly appearing in electronegative discharging having a significant effect to the instability of the plasma process, (p.0041), which is written on the abnormal plasma discharge in a chamber/impedance, indicates and an abnormal plasma discharge in said chamber. Chen et al. also disclosed teaching of an input signal to the chamber (fig.2, 21), and the monitoring of chamber impedance (para. 0022).

As to claim 4, see figure 2, part 21, input signal of radio frequency (RF) signal.

As to claims 5 and 6, Chen teaches the impedance detector further comprises a peak detector coupled thereto, the peak detector comprises a peak current detector and a peak voltage detector, for measuring peak values of voltage and current signals of the input signal (p.0023), which is written on impedance indicates the voltage of the chamber, as in claim 5, and is written on an abrupt change in said impedance comprises an abrupt drop in peak-to-peak voltage of said chamber, as in claim 6.

As to claim 8, figure 4 illustrates modulation of RF signals generated by signal generators of Chen et al.'s disclosure, which paragraph 40 teaches (figure 4) impedance meter 54 is connected to the power output terminal of RF power supply 53 and the outputs of the impedance meter 54 are coupled to the plasma 55 and A/D

converter 56, respectively, which is written on the "process of providing said input signal uses electrical contacts connected to said chamber and said process of monitoring said impedance measures impedance of said electrical contacts."

As to claim 12, see paragraph 38, for Chen et al.'s disclosure of recording the power and time.

As to claim 14, see discussion of claim 2, wherein said input signal comprises a radio frequency (RF) signal.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 2, 3, 11, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. of US 2004/0116080.

Chen et al. fails to clearly define that the input signal comprises a ramped (or increasing) signal, as in claims 2, 3, 11, and 13.

As to claim 2, Chen et al. teaches an input power meter of pulse RF plasma, and further teaches input pulse frequency can be between 0.0001%-100%, which demonstrates the capability to be ramped.

As to claim 3, Chen et al. provides an input power meter of pulse RF plasma and further teaches the pulse signals of the RF plasma can be any types of waves, such as square waves, sine waves, delta waves, or trapezoidal waves (para. 33), which demonstrates the "ramped signal includes one of a step ramped signal and a smooth ramped signal."

As to claim 11, all the limitations have been disclosed by Chen et al. and discussed above. See claim 1, for method of detecting plasma leakage in a reactive ion etching (RIE) chamber; see claim 8, for providing an input signal to said chamber using electrical contacts; see claims 5 and 6, for monitoring impedance of said electrical contacts to determine the voltage of said chamber, wherein an abrupt drop in peak-to-peak voltage of said chamber indicates plasma leakage in said chamber, see discussion in claim 3, where Chen disclosed a variety of shapes of the wave which demonstrates: ramped input from positive to negative, and a gradual increase in the power of the input signal.

As to claim 13, see discussion in claim 3 and claim 11, where Chen et al.'s teachings are written on "process of gradually increasing the power of said input signal comprises supplying one of a step ramped signal and a smooth ramped signal."

Although Chen et al. fails to clearly teach the input signal comprises a ramped signal, as in claims 2, 3, 11, and 13 Chen does succeed in teaching input power meter of pulse RF plasma with pulse frequencies between 0.0001%-100%, which clearly demonstrates the capability to be ramped.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to include the capability of ramped, or increased, plasma when forming the plasma impedance meter, of Chen, because it provides the benefit of a

metered process control. Furthermore Chen teaches timely detection of process problems reduce scrap and allowing the scheduling of maintenance, for manufacturing cost savings.

***Claim Rejections - 35 USC § 103***

Claims 7 and 15 are rejected under 35 U.S.C. 103(a) as being obvious over Chen et al. of US 2004/0116080 in view of Angra et al. of Pramana – journal of Physics, Vol., 54 No. 5, May 2000, pp. 763-769: Unstable Plasma Characteristics in Mirror Field Electron Cyclotron Resonance, Microwave Ion Source.

Chen does not teach an abrupt change in impedance comprises a drop of greater than 5%, as in claims 7 and 15.

Angra et al. teaches known abrupt changes observed in plasma reflective power were measured between less than 2% and about 50%, which encompasses the claimed range of a drop of greater than 5%, as in claims 7 and 15.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to consider a drop of 5% or greater an abrupt change, as in Angra et al., when performing the real time monitoring of plasma, as Chen et al., because Angra teaches it is known that unstable plasma regions are found to be dependent on magnetic field.

***Claim Rejections - 35 USC § 103***

Claim 9 is rejected under 35 U.S.C. 103(a) as being obvious over Chen et al. of US 2004/0116080 in view of Manabu et al. of JP 2003173973.

Chen fails to disclose abnormal plasma discharge comprises plasma leakage, as in claim 9.

Manabu discloses, when abnormality discharge occurs in the plasma, it is known that the semiconductor device on a wafer carries out the charge up (D.D. para. 4) which is written on an abnormal plasma discharge comprising plasma leakage, As to claim 9.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to identify abnormal plasma discharge comprises plasma leakage, as in Manabu, when performing the real time monitoring of plasma, as Chen et al., because reduction of material wasted will reduce cost.

### ***Claim Rejections - 35 USC § 103***

Claims 10 and 16 are rejected under 35 U.S.C. 103(a) as being obvious over Chen et al. of SN 10/178381 in view of Takahashi of 2004/0129218.

Chen does not teach plasma leakage comprises formation of a plasma secondary to the primary plasma location, as in claims 10 and 16.

Takahashi teaches the use of a magnetic field to prevent a commonly known problem of plasma leakage from creating damage because it can forming a plasma in a region of the chamber not intended to have a plasma (para. 49), which is written on plasma leakage comprises formation of a region of secondary plasma in a location different from a primary plasma formation location, as in claims 10 and 16.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to identify plasma leakage comprises formation of a plasma secondary to the primary plasma location, as in Takahashi, when performing the real



time monitoring of plasma, as Chen et al., because Takahashi teaches, it is a commonly known problem.

***Claim Rejections - 35 USC § 103***

Claim 17 is rejected under 35 U.S.C. 103(a) as being obvious over Chen et al. of US 2004/0116080 in view of Hanson et al. of Advanced Energy: Optimizing Chemical Vapor Deposition Processing Through RF Metrology, 1999.

Chen et al. teaches an invention which is suitable to dynamically analyze ion energy (p. 0042), but never specifically teaches defect review related to abnormal process conditions, as in claim 17.

Hansen et al. teaches conventional statistical process control when correlating power levels, i.e. voltage drops (figure 8), and use of "Go-No-Go" analysis to determine the correlation between adjustable process parameters and wafer results (page 5, col.1, para.3) to implement a strategy for determining warning and alarm limits (page 2, col. 1, para 3, l.9-16), which is written on "correlating the power level with drop in voltage occurred with a specific chamber defect."

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to correlating a power drop with a specific chamber defect, as Hansen et al., when performing the real time monitoring of plasma, as Chen et al., because Hansen teaches statistical process control practices that are conventional and well known in the semiconductor industry.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: US 2004/0135590; US 2004/0055868, US 2003/0121609, US 2005/0145334, US 2004/0149384, USPN 5,925,212; and US 2002/0039887 teaches conventional signal shapes, including step and smooth ramped; USPN 6,661,250 teaches conventional and effective responses of an impedance control circuit and how voltage indicates impedance and changes in impedance impact voltage, change in peak-to-peak chamber voltage; USPN 6,756,790 teaches the input signal comes from electrical contacts which measure impedance.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patricia A. George whose telephone number is (571)272-5955. The examiner can normally be reached on weekdays between 7:00am and 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571)272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



PAG  
09/05

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